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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/603,147	06/23/2000	John T. Moore	MI22-1443	3541

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EXAMINER

KIELIN, ERIK J

ART UNIT	PAPER NUMBER
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2813

DATE MAILED: 03/06/2002

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/603,147

Applicant(s)

MOORE ET AL.

Examiner

Erik Kielin

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 09 January 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 64-68, 70-81 and 83-86 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 64-68, 70-81 and 83-86 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 7,8.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

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DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 68, 74, 75, and 76-79 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's admitted prior art (**AAPA**) in view of US 5,935,873 (**Spuler et al.**).

The **AAPA** clearly discloses each of the features of forming the DRAM including the three nodes 14, 16, 18 in gated electrical connection via wordlines 20, 22 with sidewalls 28, 30; capacitor constructions 36, 38; bit line contact 46; the etch stop 32 proximate the wordlines and contacting a portion of the storage node. The capacitor construction comprises the storage node, dielectric and second electrode. The wordline comprises a conductive gate with sidewalls. (See Prior Art Figures 1-4 and specification, section entitled, "Background of Invention" -- especially pp. 5-8.)

Spuler teaches the benefits of forming an etch stop layer 22 comprising carbon, specifically carbon-doped silicon nitride by using known deposition methods or by implantation of carbon into silicon nitride to provide good etch selectivity when an oxide layer 30 is deposited thereover. (See col. 2, l. 39 to col. 3, l. 35.) The carbon content is 1% to 50% -preferably 10-30%.

It would have been obvious to one of ordinary skill at the time of the invention to use the etch stop layer of **Spuler** in the **AAPA** production for the reasons in **Spuler** or, more specifically, that the carbon-doped silicon nitride in the etch stop layer provides better etch selectivity relative to oxides than silicon nitride alone, as is also taught also by the instant specification.

Regarding claim 79, **Spuler** also teaches forming the etch stop 22 adjacent the gate (wordline) structure 12, 14, 16 (col. 2, ll. 8-24) which inherently serve as sidewall spacers. It would have been obvious to one of ordinary skill at the time of the invention to form the etch stop adjacent the wordlines in order to provide protection to the gate structure during etching, as this is desired in both **Spuler** and in the **AAPA**.

3. Claims 68, 70-75 and 76-78, 81, 83-86 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's admitted prior art (**AAPA**) in view of JP 10-223758 (**Nobuhisa**) and further in view of **Spuler**.

AAPA, as indicated above, teaches all of the features of the claims except for the indicating that the etch stop layer comprises silicon, oxygen, and carbon (claim 53) or silicon, oxygen, nitrogen, and carbon.

Nobuhisa teaches the benefits of forming an etch stop layer 20 comprising at least one of (1) silicon carbide (2) silicon, carbon, oxygen, and (3) silicon, carbon, oxygen, and nitrogen by implanting carbon and/or nitrogen into silicon dioxide layer 4b. Note that although, **Nobuhisa** teaches that SiC or SiCN is formed, it is held absent evidence to the contrary that oxygen is necessarily present because the carbon and nitrogen are implanted into silicon dioxide. (See

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paragraphs [0036]-[0039] and especially [0053] which states that both carbon and nitrogen are implanted; Figs. 4-6.)

It would have been obvious to one of ordinary skill at the time of the invention to form the etch stop with the materials taught by **Nobuhisa** for the reasons in **Nobuhisa**, specifically to form an etch-resistant etch stop layer relative to silicon dioxide.

Then the only difference is that the specified amount of 2% to 20% carbon by weight is not taught.

Spuler teaches the appropriate amount of carbon in an etch resistant material for providing good selectivity relative to non-carbon containing dielectric materials is 1 to 50% or preferably 10% to 30%.

It would have been obvious to one of ordinary skill at the time of the invention was made to use the amount of carbon suggested in **Spuler** for the carbon resistant material taught in **Nobuhisa** for the reasons indicated in **Spuler** and because **Nobuhisa** is not limited to any amount of carbon except for that amount that gives the desired etch selectivity that **Nobuhisa** teaches which is the subject of the patent.

Further in this regard, although the carbon quantity is not exactly as claimed by Applicant, overlapping ranges are *prima facie* obvious in the absence of unexpected results. See In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Aller, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious). The choice is obvious to optimize the amount of carbon to provide the best etch selectivity relative to a non-carbon-containing dielectric, according to precedent and the teachings of **McAnally** and **Spuler**.

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4. Claims **64-67**, and **68**, 70-75, and **76-81**, 83, 84 are rejected under 35 U.S.C. 103(a) as being unpatentable over **AAPA** in view of **McAnally** and further in view of **Spuler**.

The **AAPA** discloses all of the features of the instant invention, as noted above, except for indicating that the etch stop layer or sidewalls comprise (1) a material having carbon, (2)silicon carbide, (3) a material having carbon, silicon, and oxygen, (4) a material having carbon, silicon, and nitrogen.

McAnally teaches forming either or both the sidewalls 108 and etch stop 110 from the aforementioned compositions containing carbon to improve etch selectivity (Abstract; col. 3, lines 37-40; claim 3; col. 5, lines 10-43; col. 6, lines 25-31). It would have been obvious to one of ordinary skill at the time of the invention was made to use the etch stop of **McAnally** for the reasons indicated therein.

Then regarding claim 64, the thickness of the sidewall is not taught to be less than or equal to 500 angstroms. The selection of the sidewall thickness is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species. In re Jones, 162 USPQ 224 (CCPA 1955)(the selection of optimum ranges within prior art general conditions is obvious) and In re Boesch, 205 USPQ 215 (CCPA 1980)(discovery of optimum value of result effective variable in a known process is obvious).

It would have been obvious to one of ordinary skill at the time of the invention to choose the sidewall thickness in order to optimize the sidewalls relative to the device being formed, according to precedent.

Then the only difference is that the specified amount of 2% to 20% carbon by weight is not taught.

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Spuler teaches the appropriate amount of carbon in an etch resistant material for providing good selectivity relative to non-carbon containing dielectric materials is 1 to 50% or preferably 10% to 30%.

It would have been obvious to one of ordinary skill at the time of the invention was made to use the amount of carbon suggested in **Spuler** for the carbon resistant material taught in **McAnally** for the reasons indicated in **Spuler** and because **McAnally** is not limited to any amount of carbon except for that amount that gives the desired etch selectivity that **McAnally** teaches is the object of his invention.

Further in this regard, although the carbon quantity is not exactly as claimed by Applicant, overlapping ranges are *prima facie* obvious in the absence of unexpected results. See In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Aller, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious). The choice is obvious to optimize the amount of carbon to provided the best etch selectivity relative to a non-carbon-containing dielectric, according to precedent and the teachings of **McAnally** and **Spuler**.

Double Patenting

5. Claims 70, 72, and 73 are objected to as being substantial duplicates (claims 70 and 72 are exact duplicates). Similarly, claims 60 and 62, claims 74 and 75, claims 83 and 84, and claims 85 and 86 are substantial duplicates. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in

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wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

Response to Arguments

Applicant's arguments filed 1/9/02 have been fully considered but they are not persuasive.

Regarding the width of the sidewall spacers, Applicant is redirected to Spuler col. 2, lines 40-48. Given the disclosed dimensions of the opening, which is as small as 500 Å (0.05 μm). It is clear that the Spuler sidewall spacers are less than 500 Å. More specifically, the sidewall spacer portion is indicated to be 200 Å to 300 Å. Furthermore, as devices shrink, so do the dimensions of the features of each device according to Moore's Law. Accordingly, the choice of sidewall spacer thickness is merely a matter of routine optimization, as indicated above. Applicant has not recognized an advantage not already known in the art regarding the thickness of the spacers. In other words, one of ordinary skill would not continue to use sidewall spacers of a thickness used in a 1-μm rule, for devices in a 0.18-μm rule; instead, they would be appropriately scaled down. This would prevent a contact to the diffused regions of the semiconductor from being formed.

Applicant alleges that the combined art of AAPA and Spuler does not teach "a storage node extending along and against a material that comprises about 2% and 20% carbon (by weight)" as recited in independent claim 68. Each of Spuler and McAnally is directed to a **contact**, in general, of which a storage node **contact** is a member. The combination of AAPA in view Spuler or in view of McAnally does, in fact, teach the feature. Similar reasoning applies to

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Applicant's argument regarding independent claim 76. Further in this regard, it appears that Applicant is arguing the references separately; it is the combination that must be considered.

Applicant is reminded that the term "proximate" is defined as "close" or "very near," which does not require direct contact. Nonetheless the etch stop layers of each of Spuler and the sidewall spacers and etch stop in McAnally are in direct contact with the contact metallization. Accordingly, Applicant's assertion that the storage node **contact** is not "proximate" the carbon-containing layer is simply false. In each reference, the contact is in direct contact with the carbon-containing material.

The inclusion of the dependent claims 69 and 82 into their respective parent claims which recite 2% to 20% carbon are wholly non-persuasive amendments because Applicant has not provided any evidence of record to indicate that there is anything critical to the instantly claimed range relative to that range used in the applied prior art. Given the large extent of overlap in the ranges in the applied art of Spuler and the instant invention, it would appear that such evidence could not exist.

Regarding the duplicate claims. The content of the preamble does not appear to prevent the mutual reading-on of the claims amongst themselves because exactly the same limitations are recited in each. Furthermore, a patent found to read-on any one of the claims would read on the other claims regardless of the preamble because the limitations recited are exactly the same. Accordingly the argument that the scopes are different is not found persuasive.

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Conclusion

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

US 6,187,672 B1 (**Zhao** et al., col. 7, ll. 5-32) and US 6,171,971 B1 (**Natzle**, col. 6, ll. 1-15) and US 6,091,081 (**Matsubara** et al., col. 6, ll. 25-33) each teach forming an carbon etch stop (called "protective layer" in Zhao) to provide etch selectivity relative to silicon dioxide.

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication from examiner should be directed to Erik Kielin whose telephone number is (703) 306-5980 and e-mail address is erik.kielin@uspto.gov.


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The examiner can normally be reached by telephone on Monday through Thursday 9:00 AM until 7:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri, can be reached at (703) 306-2794 or by e-mail at olik.chaudhuri@uspto.gov. The fax phone number for the group is (703) 308-7722 or -7724.


EK

February 24, 2002


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